



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 1  
NEW ENGLAND REGIONAL LABORATORY  
OFFICE OF ENVIRONMENTAL MEASUREMENT & EVALUATION  
11 TECHNOLOGY DRIVE  
NORTH CHELMSFORD, MASSACHUSETTS 01863-2431

**Memorandum**

**To:** Nyanza Chemical Waste Dump Site File for the Sudbury River (OU4)

**From:** Bart Hoskins, EPA Ecological Risk Assessor

**Through:** Daniel Keefe, EPA Remedial Project Manager

**Subject:** Response to comments from the Metro West Growth Management Committee on the Supplemental Baseline Ecological Risk Assessment

**Date:** October 27, 2009

In December, 2008, EPA released a Supplemental Baseline Ecological Risk Assessment (SBERA) for the Nyanza Superfund Site, Operable Unit IV, Sudbury River. This SBERA describes all EPA efforts to evaluate ecological risk from mercury in the Sudbury River inclusive of the historical mercury releases which occurred during the years of operation by Nyanza Chemical Company (Nyanza). The Metro West Growth Management Committee provided comments (originally prepared on their behalf by Exponent, Inc.) on May 22<sup>nd</sup>, 2009 and a condensed version of those comments on September 30<sup>th</sup>, 2009. The following are EPA responses to the comments shared on September 30<sup>th</sup>, 2009. As it is germane to several of the comments, and to clarify, EPA is not contemplating re-issuing the SBERA; however, the comments and these responses will be made part of the Nyanza Chemical Site File for Operable Unit 4 (i.e., the Sudbury River). The following are Metro West comments (in italics) as submitted on September 2009, followed by EPA responses.

**Comment 1**

- The conceptual model for the Supplemental Baseline Ecological Risk Assessment (SBERA) identifies the most important potential routes of exposure and ecological entities, but generally lacks a detailed discussion of the rationale for the selection of specific assessment endpoints and exclusion of others, such as herbivorous mammals, reptiles, and amphibians.*

**EPA Response**

Sections 2.6 and 2.7 of the SBERA present the generic criteria for selection of Assessment and Measurement Endpoints, respectively. EPA concurs that more discussion could have been

provided on how the specific endpoints selected for the SBERA reflect these generic criteria. In the absence of the SBERA being reissued, some additional explanation is provided here.

EPA studies of mercury effects in the Sudbury River have, over the years, reflected the state of research on mercury. In 1994, EPA assembled a number of the top research scientists in the mercury research field to lead the studies that resulted in the first draft Baseline Ecological Risk Assessment (BERA), which was completed in 1999. In this time frame mercury was understood to be primarily an aquatic toxicology issue, with a focus on top predator fish (e.g., Largemouth Bass) and the birds and mammals that prey on fish (e.g., Common Loon and Mink). The Nyanza studies from this time period reflect that understanding, and also included benthic invertebrates, including mayflies and freshwater mussels.

By 2003, when EPA was preparing to finalize the BERA, current research was suggesting that mercury risk was possible outside the aquatic environment. EPA became aware of research by Rimmer et al (later published as Rimmer et al, 2005) which presented an early example of mercury bioaccumulation in a strictly terrestrial bird species. At this time researchers were starting to study mercury export from aquatic to nearby terrestrial systems. As an example, insects with aquatic life stages might be consumed by insectivorous birds living adjacent to the water body. As a result of this recent understanding, marshbird studies were added to the Nyanza project to evaluate risk to insectivorous birds living in the Great Meadows Natural Wildlife Refuge (GMNWR) adjacent to the Sudbury River.

In general, assessment endpoint selection for the BERA followed the conventional assumption that the upper trophic levels (top predators) in any food chain are at highest risk from mercury. So, EPA included direct measures of exposure to Hooded Mergansers, Kingfishers, and Mink, all of which consume fish. EPA did not include herbivorous mammals, since plants are generally very low in mercury and so would be unlikely to transfer dangerous quantities of mercury to mammals that consume plants. It is worth noting that EPA did not originally intend to include the Wood Duck as a study species, since the Wood Duck has a diet that is primarily plant-based. Wood Ducks were captured and studied as “by-catch” because they often inhabited nesting boxes intended for the Hooded Merganser. As expected, the Wood Duck blood concentrations were quite low relative to those of the higher-trophic level Hooded Merganser and Kingfisher. There is ample reason to believe that an herbivorous mammal would likewise have low mercury tissue levels. Reptiles and amphibians were not included simply because the scientific literature provides very little information for interpreting tissue levels or dietary risk to these animals.

## **Comment 2**

- *It would be helpful if the SBERA provided one table that summarized the various “lines of evidence” and types of organisms considered for each reach of the river, because these vary from reach to reach, depending on the availability of data for the various reaches.*

*Rationale for the lack of certain types of evidence for certain reaches should be presented more clearly.*

## **EPA Response**

It is true that the SBERA did not have a table summarizing the lines of evidence and types of organisms in the Problem Formulation, however Tables 4-61 to 4-70 provide this information, as well as summary conclusions for each line of evidence, on a reach-by-reach basis. These tables present the most succinct summary of all information evaluated in the SBERA by reach.

The rationale for having different lines of evidence and different measurement and assessment endpoints can be summarized fairly easily. It has long been recognized that methyl mercury is the most bioavailable form of mercury. It is also widely recognized that wetlands favor creation of methyl mercury from inorganic mercury. This is because of the presence of high organic matter and frequent flooding and drying, both of which present good conditions for the bacteria responsible for converting inorganic mercury to methyl mercury.

The Great Meadows National Wildlife Refuge (GMNWR) is a vast wetland complex associated with the Sudbury River. It required more in-depth study because it is thought to have great potential to methylate mercury (from past point sources such as Nyanza, as well as anthropogenic sources) and make it available to wildlife. Also, being a wildlife refuge, it deserves additional scrutiny for potential risk to wildlife. Reservoirs 1 and 2 were studied intensively because they are the first major impoundments downstream of the Nyanza site, and consequently have substantially higher sediment concentrations of mercury than other reaches.

So, the primary areas of interest were those reaches with very high concentrations of mercury (reservoirs) or more moderate concentrations of mercury, but higher potential to convert the available mercury to a bioavailable form (GMNWR). The remaining reaches received less study because they presented neither of these conditions to any great degree, and it was EPA's strategy to extrapolate information from the more heavily studied reaches to those where risk was less likely to be present.

## **Comment 3**

- *We note that the risk matrix does not present any scenarios for which risk is considered "probable." This presumably reflects the uncertainties underlying the lines of evidence that are included in the SBERA. Nonetheless, the risk matrix seems incomplete without inclusion of a scenario that could be used to identify circumstances that result in a probable risk, should such risks exist.*

## EPA Response

It is partly correct that the word “probable” was not used in the risk matrix because of the underlying uncertainties in the SBERA. It is EPA’s view that the top tier of the matrix (risk possible, high confidence) can be taken as essentially the same as “probable” for purposes of interpretation. Were EPA to add to the matrix, it might be to add an additional tier for risk being “readily apparent” or “certain” as might be the case if overt toxicity were observed and clearly associated with a site contaminant. In most such instances the need for a risk assessment is obviated by the fact that there is readily apparent harm.

## Comment 4

- *We found that the rationale used to reach the risk conclusions presented in the Executive Summary and Risk Characterization (Section 4.4) was not clearly presented. Specifically, the relationship of the risk findings presented in Tables 4-61 to 4-71 in the SBERA to the risk conclusions is confusing. It appears that although certain lines of evidence indicate risk for certain receptors, sufficient confidence is not placed in these lines of evidence to support a conclusion of risk. The wording of the Executive Summary and Risk Characterization should be changed to acknowledge that although various lines of evidence indicate elevated risk, levels of confidence in only certain of the lines of evidence are sufficient to support a risk conclusion of a likelihood of adverse effects above baseline.*

## EPA Response

EPA agrees that there are some instances in which the balance between evidence of risk and confidence in a given line of evidence could have been presented in a more transparent way. Unfortunately, as noted previously, the project timing does not allow for additional revision of the SBERA. To some extent the lack of clarity reflects that fact that certain of these sections were being revised and discussed by the project team to the very last days before the document was to be submitted for printing.

A case in point is the interpretation of the Tree Swallow tissue data. EPA developed extremely conservative (i.e., protective) critical body residue (CBR) concentration values for Tree Swallow blood in order to interpret the field study. CBRs are tissue concentrations that would be associated with adverse effects; are developed from the scientific literature; and are more likely to over-estimate risk than to underestimate risk. The Tree Swallow study was seen as a particularly strong line of evidence because it was a fairly robust data set based on measured tissue concentrations. According to the CBRs, we would expect risk to tree swallows in certain reaches, however the field of mercury research produced contradictory evidence within days of

the SBERA going final. Through discussions with experts in mercury effects on wildlife, EPA became aware of research (later published as Brasso and Cristol (2008)) on Tree Swallows at a contaminated site at the headwaters of the Shenandoah River in Virginia. In this study potential population-level adverse effects were only observed at Tree Swallow blood concentrations far higher than any observed in the Sudbury River. This led EPA to put less weight on the CBR, since the Brasso and Cristol study was more species-specific, and it provided an indication that the EPA CBR had potential to substantially over-estimate risk.

It is as a consequence of this final check of the literature and extensive internal discussions that EPA was not able to fully describe all the nuances of the interactions between evidence for and against risk, and the confidence level for each line of evidence.

#### **Comment 5**

- *The Executive Summary and the Risk Characterization discuss various issues related to the final risk conclusions, including uncertainties related to the lines of evidence, lack of concordance among lines of evidence, and issues related to regional levels of mercury. The SBERA concludes that the “results of the SBERA do not indicate that mercury contamination resulting from Nyanza Site discharges are likely to result in population-level risk to ecological receptors residing in or using the Sudbury River.” In general, we agree with the conclusions of the risk assessment, but feel that this statement does not clearly convey the findings of the SBERA. It would be clearer to state that, based on the results of the SBERA, one cannot conclude with a high level of confidence that any populations are at risk from exposure to mercury.*

#### **EPA Response**

EPA concurs that the suggested wording would accurately reflect the findings of the SBERA. As a practical matter the existing and suggested wordings would both likely produce similar scientific management decisions, after which point the fine nuances of the conclusions can easily be lost. It is a challenge presented by the constantly-evolving field of mercury research, and the fact that the Superfund program guidance generally requires a population-level risk to drive a remedy. EPA designed the SBERA to be conservative and comprehensive because a population-level risk is a difficult bar to reach.

#### **References**

Brasso, Rebecca L. , and Daniel A Cristol. 2007. *Effects of mercury exposure on the reproductive success of tree swallows (Tachycineta bicolor)*. Ecotoxicology (2008) 17:133–141 (Published Online 14 August 2007).

Rimmer, Christopher C., Kent P. McFarland, David C. Evers, Eric K. Miller, Yves Aubry, Daniel Busby, and Robert J. Taylor. 2005. *Mercury Concentrations in Bicknell's Thrush and Other Insectivorous Passerines in Montane Forests of Northeastern North America*. *Ecotoxicology*, 14, 223-240, 2005